WHAT IS CLAIMED IS:

1. An actuator comprising:

a fixed iron core unit including first to fourth iron cores, the first iron core having a closed core portion and groovelike channels which are formed between the closed core portion and a pair of projecting portions extending inward from opposite sides of the closed core portion along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portion, the second iron core having a closed core portion, and the third and fourth iron cores individually having split core portions, in which the closed core portions of the first and second iron cores are placed face to face at a specific distance from each other along the y-axis direction in such a manner that they overlap each other as viewed along the y-axis direction, the third and fourth iron cores are placed face to face with each other along the x-axis direction between the first and second iron cores in such a manner that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores as viewed along the y-axis direction, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth

iron cores together form an armature accommodating space surrounded thereby;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature; and

a coil including a bobbin and a winding wound around the bobbin, the bobbin having projections extending along the z-axis direction;

wherein the coil is kept from being displaced along the x- and z-axis directions as it is fitted in the groovelike channels formed in the first iron core, the coil is kept from being displaced along the y-axis direction as the projections of the bobbin are sandwiched between the first and second iron cores from both sides along the y-axis direction, and the armature of said armature unit is accommodated in the armature accommodating space and supported movably along the z-axis direction by the first and second rod members which are fitted in bearings provided in said fixed iron core unit.

2. An actuator comprising:

a fixed iron core unit including first to fourth iron cores, the first and second iron cores individually having closed core portions, and the third and fourth iron cores individually having split core portions, in which the third

and fourth iron cores are placed face to face with each other along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portions between the first and second iron cores in such a manner that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores as viewed along the y-axis direction, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth iron cores together form an armature accommodating space surrounded thereby;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature; and

bearings sandwiched between the split core portions of the third and fourth iron cores from both sides along the x-axis direction and held therebetween;

wherein the armature of said armature unit is accommodated in the armature accommodating space and supported movably along the z-axis direction by the first and second rod members which are fitted in said bearings, and the armature is caused to move from a first position to a second position, and vice versa, along the z-axis

direction by exciting a coil.

3. The actuator according to claim 2, wherein grooves cut in the x-axis direction are formed in facing end surfaces of the third and fourth iron cores, said bearings individually have main portions and projecting portions extending along the x-axis direction from the main portions, the main portions of said bearings are sandwiched between the third and fourth iron cores from both sides along the x-axis direction and held therebetween, and the projecting portions of said bearings are fitted in the grooves, whereby said bearings are kept from moving at least along one of the y- and z-axis directions.

4. The actuator according to claim 3, wherein the grooves extend along at least along one of the y- and z-axis directions, and the projecting portions of said bearings are fitted in the grooves, whereby said bearings are kept from moving at least along one of the y- and z-axis directions.

5. The actuator according to claim 2, wherein the third and fourth iron cores are formed by laminating magnetic steel sheets.

6. The actuator according to claim 1 further comprising permanent magnets;

wherein the projecting portions of the first iron core constitute a pair of projecting magnetic poles extending face to face along the x-axis direction from the opposite sides of the closed core portion of the first iron core leaving a specific gap in between along the x-axis direction, the second iron core has a pair of projecting magnetic poles extending face to face along the x-axis direction from opposite sides of the closed core portion of the second iron core leaving a specific gap in between along the x-axis direction, the third and fourth iron cores individually have projecting magnetic poles extending along the x-axis direction from inside surfaces of the split core portions, the projecting magnetic poles of the first and second iron cores on one side and the projecting magnetic pole of the third iron core together constitute an opposing magnetic pole, and the projecting magnetic poles of the first and second iron cores on the other side and the projecting magnetic pole of the fourth iron core together constitute another opposing magnetic pole; and

wherein said permanent magnets are provided between the opposing magnetic poles and the armature and affixed to the opposing magnetic poles or the armature, and the armature is held at a first position and a second position

along the z-axis direction by magnetic forces produced by the permanent magnets and caused to move from the first position to the second position, and vice versa, along the z-axis direction by exciting the coil.

7. The actuator according to claim 6, wherein the permanent magnets are embedded in recesses formed in the armature and affixed thereto in such a manner that the permanent magnets become flush with surfaces of the armature.

8. The actuator according to claim 6 further comprising support plates fixed to the armature or the opposing magnetic poles, each of the support plates covering a surface of each permanent magnet, whereby the support plates can slide along the armature or the opposing magnetic poles.

9. The actuator according to claim 8, wherein both ends of each of the support plates are oppositely extended along the z-axis direction forming extended portions which are curved in such a direction that the extended portions grip each of the permanent magnets.

10. The actuator according to claim 6, wherein said

bearings are sandwiched between the split core portions of the third and fourth iron cores from both sides along the x-axis direction and held therebetween.

11. The actuator according to claim 10, wherein grooves cut in the x-axis direction are formed in facing end surfaces of the third and fourth iron cores, said bearings individually have main portions and projecting portions, the main portions of said bearings are sandwiched between the third and fourth iron cores from both sides along the x-axis direction and held therebetween, and the projecting portions of said bearings are fitted in the grooves, whereby said bearings are kept from moving along the z-axis direction.

12. The actuator according to claim 10, wherein the armature accommodating space permits the permanent magnets to be inserted between the opposing magnetic poles and the armature along the y-axis direction.

13. The actuator according to claim 1, wherein said fixed iron core unit includes a fifth iron core and a permanent magnet, the fifth iron core being provided on the outside of at least one of the closed core portions of the first and second iron cores with an end of the fifth iron

core disposed face to face with the armature along the y-axis direction, the fifth iron core constituting part of a magnetic circuit in which a magnetic flux passes from said one of the closed core portions through the interior of the armature along its moving direction and returns to said one of the closed core portions, and the permanent magnet being provided in the magnetic circuit, and wherein the armature is held at a first position and a second position along the z-axis direction by a magnetic force produced by the permanent magnet and caused to move from the first position to the second position, and vice versa, along the z-axis direction by exciting the coil.

14. The actuator according to claim 1, wherein the armature has a through hole formed through itself along the z-axis direction and an internally threaded portion formed at about the middle of the through hole, and the first and second rod members each have a shank portion having a smooth surface and an externally threaded portion which is screwed into the internally threaded portion of the through hole in the armature, whereby one end of the first rod member and one end of the second rod member are held in contact with each other.

15. The actuator according to claim 14, wherein the

shank portions of the first and second rod members are in direct contact with an inside surface of the through hole in the armature and supported thereby.

16. The actuator according to claim 14, wherein the first and second rod members are made of a nonmagnetic material.

17. The actuator according to claim 1, wherein at least one of the armature and the first to fourth iron cores is formed by laminating magnetic steel sheets.

18. A method of manufacturing an actuator which comprises:

a fixed iron core unit including first to fourth iron cores, the first iron core having a closed core portion and groovelike channels which are formed between the closed core portion and a pair of projecting portions extending inward from opposite sides of the closed core portion along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portion, the second iron core having a closed core portion, and the third and fourth iron cores individually having split core portions, in which the closed core portions of the first and second iron cores are placed face to face at a specific

distance from each other along the y-axis direction in such a manner that they overlap each other as viewed along the y-axis direction, the third and fourth iron cores are placed face to face with each other along the x-axis direction between the first and second iron cores in such a manner that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores as viewed along the y-axis direction, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth iron cores together form an armature accommodating space surrounded thereby;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature;

coils each including a bobbin and a winding wound around the bobbin, the bobbin having projections extending along the z-axis direction; and

permanent magnets;

wherein the coils are kept from being displaced along the x- and z-axis directions as they are fitted in the groovelike channels formed in the first iron core, the coils are kept from being displaced along the y-axis

direction as the projections of the bobbins are sandwiched between the first and second iron cores from both sides along the y-axis direction, and the armature of said armature unit is accommodated in the armature accommodating space and supported movably along the z-axis direction by the first and second rod members which are fitted in bearings provided in said fixed iron core unit;

wherein the projecting portions of the first iron core constitute a pair of projecting magnetic poles extending face to face along the x-axis direction from the opposite sides of the closed core portion of the first iron core leaving a specific gap in between along the x-axis direction, the second iron core has a pair of projecting magnetic poles extending face to face along the x-axis direction from opposite sides of the closed core portion of the second iron core leaving a specific gap in between along the x-axis direction, the third and fourth iron cores individually have projecting magnetic poles extending along the x-axis direction from inside surfaces of the split core portions, the projecting magnetic poles of the first and second iron cores on one side and the projecting magnetic pole of the third iron core together constitute an opposing magnetic pole, and the projecting magnetic poles of the first and second iron cores on the other side and the projecting magnetic pole of the fourth iron core together

constitute another opposing magnetic pole;

wherein said permanent magnets are provided between the opposing magnetic poles and the armature and affixed to the opposing magnetic poles or the armature, and the armature is held at a first position and a second position along the z-axis direction by magnetic forces produced by the permanent magnets and caused to move from the first position to the second position, and vice versa, along the z-axis direction by exciting the coils;

wherein said bearings are sandwiched between the split core portions of the third and fourth iron cores from both sides along the x-axis direction and held therebetween; and

wherein the armature accommodating space permits the permanent magnets to be inserted between the opposing magnetic poles and the armature along the y-axis direction;

said method comprising the steps of:

attaching the first and second rod members to the armature;

passing the coils and the bearings over the first and second rod members;

sandwiching the bearings by the third and fourth iron cores from both sides along the x-axis direction to hold the bearings in position;

sandwiching the projections of the bobbins of the coils by the first and second iron cores to keep the coils

from being displaced along the y-axis direction;

inserting said permanent magnets into the armature accommodating space along the y-axis direction and fixing said permanent magnets to the opposing magnetic poles or the armature.

19. A circuit breaker comprising:

the actuator according to claim 6; and

a switching device of which contacts are opened and closed by the actuator with one of the contacts connected to the first or second rod member of the actuator.